REMARKS

Claims 1-4, 11-14, and 38-50 are all the claims presently pending in the application. Claims 1, 4, and 11-13 are amended to more clearly define the invention, claims 5-10 and 15-37 are canceled, and claims 38-50 are added. Claims 1 and 50 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also notes that, notwithstanding any claim amendments herein or later during prosecution, Applicants' intent is to encompass equivalents of all claim elements.

Claims 1-2, 10-12, 15-19, 28-30, and 33-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Gall reference. Claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Laster reference. Claims 1-2, 4, 7-8, 11-12, 16-17, 19, 21-26, 28-30, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Ostrovsky et al. reference. Claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Laughlin reference. Claims 3, 9, 13-14, 20, 27, and 31-32 stand rejected under 35 U.S.C. § 103(a) as being anticipated by the Ostrovsky et al. reference.

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

An exemplary embodiment of the claimed invention, as defined by, for example, independent claim 1, is directed to a cross joint that includes a cross shaft member, rolling members and bearing cups. The cross shaft member includes four shafts each including a

neck portion and a race portion, and shoulder portions between adjacent neck portions. The rolling members are adapted to rotate on the race portions. The bearing cups are fitted to the respective shafts via the rolling members. Each of the shoulder portions include a round-shaped section in a section including an axis center of the shaft. The round-shaped section has a center of curvature at an outer side of the cross shaft member. The round-shaped section does not include a concave corner. The race portions and the shoulder portions are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces. Further, a residual compressive stress at a depth of at least 0.3 mm from each of surface of the race portions and the shoulder portions subjected to roller burnishing is larger than a residual compressive stress at the deeper portions thereof.

Conventional cross joints have experienced fatigue breaking or bending fatigue at the shoulder area between the shaft neck areas because of the large bending stress experienced during operation.

Further, conventional cross joint shoulder include concave corners which are impossible to roller burnish and, therefore, have a high risk of failure.

In stark contrast to the conventional cross joints, the present invention provides roller burnished shoulder portions that include a round-shaped section which does not include a concave corner. In this manner, the entire surface of the round-shaped section is roller burnished and, as a result, the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders is increased and, therefore, the life of the cross joint is extended.

II. THE EXAMINER'S RESPONSE TO ARGUMENTS

Examiner Binda points out that independent claims 1 and 16 are product-by-process claims in that the structure of the claimed product is defined by the process that produced the product.

Examiner Binda also alleges that the patentability of the product does not depend upon its method of production.

However, Applicants respectfully submit that it is the structure that is provided by the process of making the claimed cross joint for which Applicants seek protection.

> "The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to limit structure of the claimed composite and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are capable of construction as structural limitations.)" M.P.E.P. § 2113.

In this particular instance, the claims recite a "roller burnished shoulder," and, as explained above, the fact that the shoulder is "roller burnished" imparts "distinctive structural characteristics" (M.P.E.P. § 2113) to the shoulder which increases the fatigue strength of the shoulder, the hardness of the surface of shoulder, and the residual compressive stress of the shoulder. These "distinctive structural characteristics" which are imparted by the process

steps (M.P.E.P. § 2113) provide distinct advantages over conventional cross joints because they increase the service life of the cross joint.

Therefore, Applicants respectfully submit that "distinctive structural characteristics" which are imparted by the roller burnishing process steps are not taught or suggested by the applied references and Applicants respectfully request withdrawal of the applied art rejections and allowance of the present application.

The Examiner has also alleged that product-by-process claims are not patentable.

Clearly, this allegation by the Examiner starkly contradicts the fact that product-by-process claims are patentable and features of such claims are entitled to patentable weight as very clearly explained by M.P.E.P. § 2113.

The Examiner's continued refusal to provide these features with patentable weight is a clear violation of the specific instructions provided by the M.P.E.P.

Should the Examiner continue to allege that such claims are not entitled to patentable weight, Applicants respectfully request that the Examiner provide a specific citation to the M.P.E.P. which the Examiner alleges supports the Examiner's position. Without such a citation in support of the Examiner's position, Applicants submit that the Examiner is simply applying a confused and incorrect understanding of U.S. Patent Law.

III. THE PRIOR ART REJECTIONS

A. The Gall reference rejection

Regarding the rejection of claims 1-2, 10-12, 15-19, 28-30 and 33-37, the Examiner continues to allege that the Gall reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor

suggested by the Gall reference.

None of the applied references teaches or suggests the features of the claimed invention including roller burnished shoulder portions that include a round-shaped section which does not include a concave corner. As explained above, this feature is important for roller burnishing the entire surface of the round-shaped section, so that the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders is increased across the entire surface and, therefore, the life of the cross joint is extended.

Clearly, the Gall reference does not teach or suggest a round-shaped section which does not include a concave corner. Indeed, the Gall reference specifically discloses a shoulder section having concave corners.

Further, as explained previously, the Gall reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). This feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Gall reference discloses that a heat treatment is performed after roller burnishing and, thus, a hardness of each of the surfaces of the race portions and the shoulder portions and the residual compressive stress immediately below these surfaces are not increased.

Indeed, the Gall reference actually teaches away from performing a heat treatment before roller burnishing because it would be difficult to form the grooves by plastic deformation.

In particular, the Gall reference discloses a cross joint which includes trunnions (shafts) which are grooved to provide alternately spaced lands 30 and grooves 32 for

providing improved oil retention (page 2, lines 3-7). The Gall reference further discloses roll burnishing the shafts to create a projection 29 on either side of the groove 32 which slightly overlaps the bottom 27 of the groove (Fig. 5, page 2, lines 22-27). Therefore, the Gall reference only discloses roll burnishing the shafts and does not teach or suggest a roller burnished shoulder.

Indeed, the Examiner does not allege that the Gall reference discloses shoulder portions that are subjected to roller burnishing as recited by the independent claims.

Therefore, the Gall reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection.

B. The Laster reference rejection

Regarding the rejection of claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30 and 34-37, the Examiner continues to allege that the Laster reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Laster reference.

None of the applied references teaches or suggests the features of the claimed invention including roller burnished shoulder portions that include a round-shaped section which does not include a concave corner. As explained above, this feature is important for roller burnishing the entire surface of the round-shaped section, so that the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders is increased across the entire surface and, therefore, the life of the cross joint is extended.

Clearly, the Laster reference does not teach or suggest a round-shaped section which does not include a concave corner. Indeed, the Laster reference specifically discloses a

shoulder section having concave corners.

Further, as explained before, the Laster reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Laster reference discloses an induction heating tool 58 that heats the surfaces of the races 55 and 56 (col. 2, lines 59-63). Therefore, for the same reason explained above with respect to the Gall reference, the Laster reference does not disclose increasing a hardness of each of the surfaces of the race portions and the shoulder portions and increasing the residual compressive stress immediately below these surfaces.

Rather, the Laster reference only discloses burnishing the "inner and outer races 55 and 56" of the cross joint (col. 2, lines 57-59 and col. 3, lines 30-31).

Indeed, the Laster reference does not mention doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Further, the Examiner does not allege that the Laster reference teaches doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Therefore, the Laster reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30 and 34-37.

C. The Ostrovsky et al. reference rejection

Regarding the rejections of claims 1-3, 4, 7-9, 11-14, 16-17, 19-31, and 34-37, the Examiner alleges that the Ostrovsky et al. reference teaches and/or renders the claimed invention unpatentable. Applicants continue to submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Ostrovsky et al. reference.

None of the applied references teaches or suggests the features of the claimed invention including roller burnished shoulder portions that include a round-shaped section which does not include a concave corner. As explained above, this feature is important for roller burnishing the entire surface of the round-shaped section, so that the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders is increased across the entire surface and, therefore, the life of the cross joint is extended.

Clearly, the Ostrovsky et al. reference does not teach or suggest a round-shaped section which does not include a concave corner. Indeed, the Ostrovsky et al. reference specifically discloses a shoulder section having concave corners.

Further, the Ostrovsky et al. reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

Indeed, the Ostrovsky et al. reference does not mention anything at all that is even remotely related to roller burnishing, let alone roller burnishing a shoulder.

Further, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder.

As is clearly explained by the specification of the present application, roller burnishing tends to increase the hardness of a material. Therefore the present invention increases the hardness of the shoulder area of the cross joint by roller burnishing the shoulder.

In stark contrast, the Ostrovsky et al. reference specifically explains that "the sections near the base of the cross arm must have a higher resistance to static and impact bending. Therefore, the hardness of these sections must be lower in order to reduce brittleness." (Emphasis added, col. 1, lines 25-29; col. 2, lines 31-40).

In other words, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder because roller burnishing increases the hardness of the shoulder and the Ostrovsky et al. reference specifically teaches that the shoulder hardness "must be lower."

Further, the Examiner does not allege that the the Ostrovsky et al. reference mentions anything at all that is even remotely related to roller burnishing, let alone roller burnishing a shoulder.

Therefore, the Ostrovsky et al. reference clearly does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw these rejections of claims 1-3, 4, 7-9, 11-14, 16-17, 19-31, and 34-37.

D. The Laughlin reference rejection

Regarding the rejection of claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37, the Examiner continues to allege that the Laughlin reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are

neither taught nor suggested by the Laughlin reference.

None of the applied references teaches or suggests the features of the claimed invention including roller burnished shoulder portions that include a round-shaped section which does not include a concave corner. As explained above, this feature is important for roller burnishing the entire surface of the round-shaped section, so that the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders is increased across the entire surface and, therefore, the life of the cross joint is extended.

Clearly, the Laughlin reference does not teach or suggest a round-shaped section which does not include a concave corner. Indeed, the Laughlin reference specifically discloses a shoulder section having concave corners.

Further, the Laughlin reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Laughlin reference discloses a universal joint which provides a "particularly efficient fluid-tight joint at the outer end of each of the trunnion pins so that light or thin commercial oil may be used to lubricate the moving parts of the joint without leakage." (Col. 1, lines 5-10).

The Laughlin reference does not mention doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Further, the Examiner does not allege that the Laughlin reference teaches doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Therefore, the Laughlin reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37.

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that claims 1-4, 11-14, and 38-50, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 12/7/05

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